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## INNOVATIONS AND SAFETY FOR COAL MINES IN UKRAINE

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## ІННОВАЦІЇ ТА БЕЗПЕКА ДЛЯ ВУГІЛЬНИХ ШАХТ УКРАЇНИ

**Purpose.** Analysis of the Ukrainian coal industry state in the view of the events taking place in the east of the country.

**Findings.** The article describes the distribution of mine fund over the territory, the number of mines relating to various forms of ownership being in operation and maintained in life-support mode including the mines belonging to DTEK Company. Volumes of coal production are presented. The deficit of different coal ranks has been assessed. The demand of the electric power plants for the coal of A and L ranks has been determined.

**Practical value.** The results may be used for strategic planning of different coal ranks production for the needs of power and metallurgical industries of Ukraine.

**Keywords:** *coal industry, traded coal, coal rank, electric power industry, metallurgy, form of ownership*

**Topicality.** Today coal is the only energy carrier potentially possessed by Ukraine in volumes sufficient for practically complete providing the requirements of national economy. This factor determines leading role of coal in the context of security of energy supply of the state [1–6]. Probable coal reserves in Ukraine are 117.5 bln tons including 56 bln tons of prospected ones. In recent years the level of coal mining in Ukraine remained practically unchangeable (72–80 mln tons). In 2012 there was a record for the last decade and the coal production reached 86 mln tons (Fig. 1). By 2013 native coal industry had completely met the need of thermal power stations, heating plants, population and other consumers for coal products. However, potential of coal use in terms of electricity generation remains low. Thus, share of electric energy generated with the help of coal products is only 26 per cent in Ukraine compared to 58 per cent in Germany, 70 per cent in China, and 90 per cent in Poland (Fig. 2). The world practice demonstrates steady tendency of outrunning growth of coal use compared to other energy resources. During the last decade the world coal consumption increased by almost 50 per cent. In the same period, consumption of natural gas increased by 30 per cent, of oil and nuclear energy – by less than 10 per cent [7].

**Condition of a problem.** In the context of January, 2014 potential of Ukrainian coal industry was immense. A design capacity of all coal mining enterprises in Ukraine was 122 mln tons and a production capacity – 86 mln tons, including design and production capacity of the public sec-

tor of 75 and 42 mln tons respectively. Taking into account the capacity development (38.1 per cent of projected capacity and 63.7 per cent of production one), just the public sector had reserve in coal production growth equal not less than 15.4 mln ton.

However, large capital investment of UAH 46.6 bln including UAH 26.0 bln for the development was needed. It was intended to solve the problem exclusively by attracting of private investments which would help to increase the effectiveness of economically attractive mines as well as to carry out large-scale modernization of mine facilities. The industry privatization had to promote its active upgrading. Owing to production capacities growth of renovated mine facilities and completion of earlier started construction of mines with support by private investors, it was supposed to meet coal demand in full. It had been calculated, that coal mining in Ukraine could be increased up to 115 mln tons/year with simultaneous the industry transition to self-repayment. In this context, the volumes of coal mining for power stations would be almost 75 mln tons/year that would be sufficient to provide demand of home power industry and other consumers, including production of renewable power resources such as syngas and coal-water fuel [8–12].

Complex use of coal deposits, i.e. simultaneous coal mining and methane production, is promising as well.

To achieve the goals, the Strategy of Coal Industry Development envisaged the three stages:

- coal industry reforming (2010–2015);
- active modernization of mines by private investors (2015–2020);
- period of the industry stable growth (2020–2030).

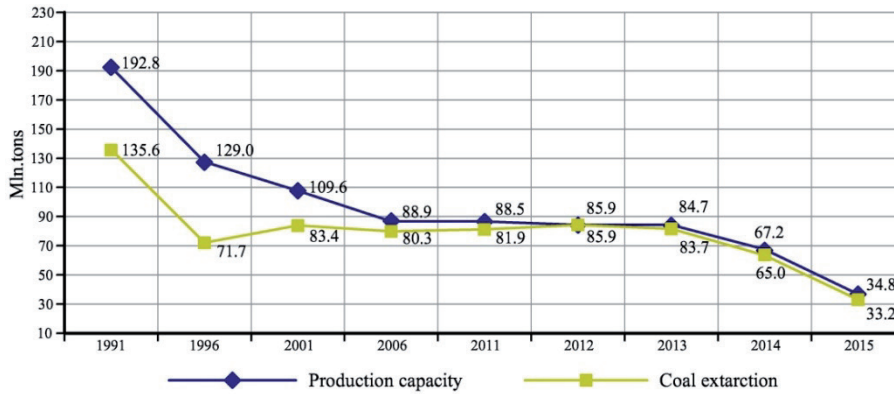


Fig.1. Dynamics of production capacities and coal mining for the period of 1991–2015

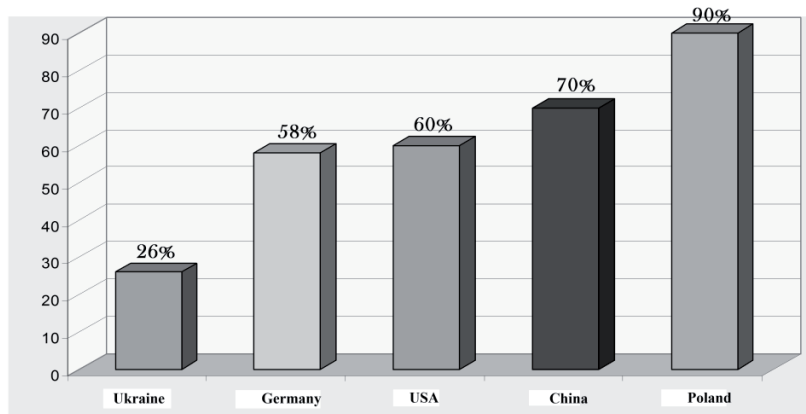


Fig. 2. Share of electric energy generated with coal use

Each the stage of coal industry development involved following governmental facilitation:

- improvement of regulatory framework of mineral resources licensing;
- complex use of coal deposits;
- state examination of construction and reconstruction projects;
- tax incentives as for investing;
- easing of credits;
- support and promotion of international cooperation.

**Main part.** Military operations in the east of Ukraine frustrated the planned development. As of 31.12.2014, there were 150 mines in Ukraine, of which 69 did not function for a variety of reasons. Today 85 mines of all forms of ownership (that is 57 per cent of their total number) are located in the territory controlled by terrorist groups.

Fifty five of ninety mines subordinated to Ministry of Energy and Coal Industry of Ukraine are in the territory controlled by separatists, and 35 mines are out of the zone of war-fighting. Of those mines 25 ones extract 11 thousand tons of coal per day on the average; 30 mines are maintained in a life-support mode (ventilation and water-pumping). Six mines of them are totally de-energized. Only 33 of 35 mines extract 21 thousand tons per day. Two mines are in water-pumping mode.

For 2014 coal mining in Ukraine amounted to 65 mln tons, that is, by 22 per cent less than for 2013. At this the public enterprises mined 17.7 mln tons of coal, or 27.2 per cent of total

coal production; 34.9 mln tons (53.7 per cent) were mined by DTEK enterprises, and 12.4 mln tons (19.1 per cent) extracted by other mines.

During 2014 enterprises of DTEK mined 12.7 mln tons of coal belonging to anthracite group (of the ranks A and L in accordance to Ukrainian classification), or 61 per cent of these ranks total output in Ukraine.

Of total output (65 mln tons), extraction the coal of A and L ranks was 20.6 mln tons, or 31.7 per cent of total mining (14.3 mln tons of A rank, and 6.3 mln tons of L rank). As compared with an analogous period of 2013 coal mining of A and L ranks reduced by 9.7 mln tons.

Major thermal power plants (TPP) consumed coal products of Donetsk and Lugansk regions are:

- Zmiyevskaya TPP owned by OJSC ‘Tsentrenergo’ (Kharkov region) that consumes 2.3 mln tons of A and L coal ranks per year.
- Tripolskaya TPP owned by OJSC ‘Tsentrenergo’ (Kiev region) consumes 1.9 mln tons of A and L coal ranks per year.
- Krivorozhskaya TPP owned by ‘DTEK Dneprenergo’ (Dnipropetrovsk region) consumes 3.2 mln tons of A and L coal ranks per year.
- Pridneprovskaya TPP owned by ‘DTEK Dneprenergo’ (Dnipropetrovsk region) consumes coal of A and L ranks. Annual consumption is 2.1 mln tons.
- Luganskaya TPP owned by ‘DTEK Vostokenergo’ (Lugansk region) consumes coal of A and L ranks. Annual consumption is 2 mln tons.

– Slavianskaya TPS owned by OJSC ‘Donbassenergo’ (Donetsk region) consumes 900 thousand tons of A and L coal ranks per year.

Due to shortage of coal of A and L ranks, DTEK company had to import 1.5 mln tons of coal from Australia and Republic of South Africa (Table).

Thus, the situation in coal industry and energy sector is critical. It requires not only the soonest political solution but also development of new technology to reduce cost price of coal mined in Ukraine. Besides, coal mines are enterprises of increased danger. Therefore, the network of institutions of coal industry that monitored safety at coal mines always ex-

isted. They were Makeyevskiy Research Institute, Fiodorov Institute of Mining Mechanics, Research Institute ‘Respirator’, DONUGI, VNIMI and a number of other institutions. Now all of them are in the territory controlled by illegal armed formations. They have lost contact with coal mines, located in the territory, controlled by the central Ukrainian authorities.

Today only the National Mining University (NMU) has a base for solving technical problems arising at coal enterprises. Therefore, according to the decision by Ministry of Energy and Coal Industry of Ukraine most of functions of those organizations were delegated to the National Mining University.

Table

Information about Imported Coal Supplied to TPP in September-December 2014, Thousand Tons

Company	Thermal Power Plant	Import to TPP				
		September	October	November	December	Total
Tsentrenergo	Tripolskaya	14.7	89.4	193.3	24.7	322.1
Tsentrenergo	Zmiyevskaya	2.0	21.5	163.1	38.3	224.9
Tsentrenergo in total		16.7	110.9	356.4	63.0	547.0
Dneprenergo DTEK	Krivrozhskaya	175.9	242.3	266.9	74.2	759.3
Dneprenergo DTEK	Pridneprovskaya	139.6	109.5	115.8	65.0	429.9
Vostokenergo DTEK	Luganskaya	87.8	95.7	92.0	35.0	310.5
DTEK Total		403.3	447.5	474.7	174.2	1499.7
Total A + L coal ranks		420.0	558.4	831.1	237.1	2046.7

Currently the agreements have been concluded almost with all mines functioning in the Ukrainian territory. Agreements on advanced training of different categories of employees, on solving tasks on electric protection, on ventilation and dust and gas conditions, on forecasts of gas-dynamic phenomena, on fire-danger, on estimation of state of surface constructions and structures, on technological parameters of coal mining and mine workings excavation, on opening and intersection of geological faults etc. are currently fulfilled.

The DTEK-ENERGO company, presently mining the main part of the coal consumed by the industry of Ukraine and producing most of thermal electric energy at thermal power plants, established DTEK Department as a part of the University. Its task is training highly skilled engineers for own coal mines and energy-generating enterprises. The Department perfectly organizes students practical training at DTEK mines.

For solving arising technical problems and supporting the developments implementation, DTEK Laboratory of Rock Mechanics has been established on the basis of the NMU. All that makes possible comprehensive solution the problems of mined coal cost reduction and provision the coal competitive abilities under compliance the required mine personnel safety level.

Fulfillment of the scheduled tasks on request of Ministry of Energy and Coal Industry of Ukraine and of mines of DTEK-ENERGO makes it possible to solve current problems of enterprises as well as a problem of own the NMU acade-

mic and scientific staff professional development, preparation Masters’ theses and PhD dissertations.

**Conclusions.**

1. Analysis of coal industry of Ukraine state has been carried out taking into account the events in the east of the country.

2. Perspectives of energy independence of Ukraine based on deposits of coal use have been outlined.

3. The coal demand of thermal power plants of Ukraine is given.

4. The role performed by DTEK Company in the coal industry of Ukraine and in training mining engineers at the National Mining University is shown.

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**Мета.** Аналіз стану вугільної промисловості України у зв'язку з подіями, що відбуваються на сході країни.

**Результат.** Показано розподіл шахтного фонду по територіях, кількість працюючих і непрацюючих шахт різних форм власності, у тому числі компанії ДТЕК, наведені обсяги видобутого вугілля. Виконано оцінку дефіциту різних марок вугілля. Визначена потреба теплових електростанцій у вугіллі марок „А“ і „Т“.

**Практична значимість.** Можливість стратегічного планування видобутку вугілля різних марок для потреб, насамперед, енергетичної та металургійної галузей промисловості України.

**Ключові слова:** вугільна промисловість, товарне вугілля, марки вугілля, електроенергетика, металургія, форма власності

**Цель.** Анализ состояния угольной промышленности Украины в связи с событиями, которые происходят на востоке страны.

**Результат.** Показано распределение шахтного фонда по территориям, количество работающих и не работающих шахт различных форм собственности, в том числе компании ДТЕК, приведены объемы добываемого угля. Выполнена оценка дефицита различных марок угля. Определена потребность тепловых электростанций в углях марок „А“ и „Т“.

**Практическая значимость.** Возможность стратегического планирования добычи угля различных марок для потребностей, прежде всего, энергетической и металлургической отраслей промышленности Украины.

**Ключевые слова:** угольная промышленность, товарный уголь, марки угля, электроэнергетика, металлургия, форма собственности

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